

**What is claimed is:**

- 1        1. A survivor path decoding apparatus for a Viterbi  
2 decoder with a constraint length of  $K$ , comprising:  
3        a best survivor unit for receiving path metrics of  $2^{K-2}$   
4        local winner states from which a best state is  
5        selected every  $L$  iterations, wherein said local  
6        winner states are chosen from  $2^{K-2}$  pairs of odd  
7        and even states, respectively; and  
8        a survivor memory comprising:  
9        a register-exchange network for receiving  
10       decision bits of  $2^{K-1}$  states and generating  
11       decision vectors of survivor paths leading  
12       to said  $2^{K-1}$  states at instant  $i$  according to  
13       said decision bits of said  $2^{K-1}$  states from  
14       instant  $i-L$  to instant  $i$ , wherein said  $2^{K-1}$   
15       states are divided into said  $2^{K-2}$  pairs of  
16       odd and even states, said decision vectors  
17       of said  $2^{K-1}$  states are output every  $L$   
18       iterations, and each of said decision  
19       vectors has a length of  $L$  bits and; and  
20       a trace-back unit for storing said decision  
21       vectors of said  $2^{K-1}$  states and finding a  
22       global survivor path sequence by following  
23       said decision vectors back from the best  
24       state at instant  $i-L$ , such that  $L$  decoded  
25       bits are output every  $L$  iterations.
- 1       2. The apparatus as recited in claim 1 wherein said  
2 best survivor unit comprises  $\gamma$  2-to-1 comparators for

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3 choosing the best state among said  $2^{K-2}$  local winner states  
4 by comparing said path metrics of said  $2^{K-2}$  local winner  
5 states in  $L-1$  iterations.

1 3. The apparatus as recited in claim 2 wherein the  
2 number of said 2-to-1 comparators,  $\gamma$ , is given by:

$$3 \quad \gamma = \left\lceil \frac{2^{K-2} - 1}{L - 1} \right\rceil$$

4 where  $\lceil \cdot \rceil$  denotes a ceiling function.

1 4. The apparatus as recited in claim 1 wherein said  
2 number of  $L$  is equal to a divisible factor of a data payload  
3 length for a conformant 802.11g system.

1 5. The apparatus as recited in claim 4 wherein said  
2 number of  $L$  is equal to 8 for said conformant 802.11g  
3 system.

1 6. The apparatus as recited in claim 1 wherein said  
2 survivor memory features a decoding window length of  
3  $\Gamma = L(L-2) + K - 1$ .

1 7. A rate  $1/n$  Viterbi decoder with a constraint length  
2 of  $K$  comprising:

3 a branch metric generator for computing a plurality of  
4 branch metrics, each of which is a distance  
5 between a corresponding branch label and a  
6 currently received data symbol including  $n$   
7 decision metrics;

8 an add-compare-select module, responsive to said branch  
9 metrics, for generating decision bits of  $2^{K-1}$   
10 states along with path metrics of  $2^{K-2}$  local

11 winner states, wherein said  $2^{K-2}$  local winner  
12 states are selected from  $2^{K-2}$  pairs of odd and  
13 even states, respectively, and said  $2^{K-1}$  states  
14 are divided into said  $2^{K-2}$  pairs of odd and even  
15 states;

16 a best survivor unit for receiving said path metrics of  
17 said  $2^{K-2}$  local winner states from said add-  
18 compare-select module and selecting a best state  
19 from among said  $2^{K-2}$  local winner states every  $L$   
20 iterations; and

21 a survivor memory comprising:

22 a register-exchange network for receiving said  
23 decision bits of said  $2^{K-1}$  states from said  
24 add-compare-select module and generating  
25 decision vectors of survivor paths leading  
26 to said  $2^{K-1}$  states at instant  $i$  according to  
27 said decision bits of said  $2^{K-1}$  states from  
28 instant  $i-L$  to instant  $i$ , wherein said  
29 decision vectors of said  $2^{K-1}$  states are  
30 output every  $L$  iterations and each of said  
31 decision vectors has a length of  $L$  bits; and

32 a trace-back unit for storing said decision  
33 vectors of said  $2^{K-1}$  states and finding a  
34 global survivor path sequence by following  
35 said decision vectors back from the best  
36 state at instant  $i-L$ , such that  $L$  decoded  
37 bits are output every  $L$  iterations.

1 8. The Viterbi decoder as recited in claim 7 wherein  
2 said best survivor unit comprises  $\gamma$  2-to-1 comparators for

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3 choosing the best state among said  $2^{K-2}$  local winner states  
4 by comparing said path metrics of said  $2^{K-2}$  local winner  
5 states in  $L-1$  iterations.

1 9. The Viterbi decoder as recited in claim 8 wherein  
2 the number of said 2-to-1 comparators,  $\gamma$ , is given by:

3 
$$\gamma = \left\lceil \frac{2^{K-2} - 1}{L - 1} \right\rceil$$

4 where  $\lceil \cdot \rceil$  denotes a ceiling function.

1 10. The Viterbi decoder as recited in claim 7 wherein  
2 said number of  $L$  is equal to a divisible factor of a data  
3 payload length for a conformant 802.11g system.

1 11. The Viterbi decoder as recited in claim 10 wherein  
2 said number of  $L$  is equal to 8 for said conformant 802.11g  
3 system.

1 12. The Viterbi decoder as recited in claim 7 wherein  
2 said survivor memory features a decoding window length of  
3  $\Gamma = L(L-2) + K - 1$ .

1 13. The Viterbi decoder as recited in claim 7 wherein  
2 said decision metrics are hard-decision data if quantized to  
3 one-bit precision.

1 14. The Viterbi decoder as recited in claim 7 wherein  
2 said decision metrics are soft-decision data if quantized  
3 with more than one bit of precision.